

Amendment Under 37 C.F.R. § 1.111  
U.S. Application No. 10/528,152

**AMENDMENTS TO THE DRAWINGS**

Replacement Drawings

Figure 5 and Figure 7

Attachment: Replacement Sheet(s)

### **REMARKS**

Claims 21-43, all the claims pending in the application, stand rejected. Claims 21, 22, 27, 31, 38-40 and 43 are amended. New claims 44 and 45 are added.

#### ***Drawings***

The Examiner objects to the drawings because the Examiner believes that Figs. 5 and 7 should be labeled as "Prior Art." A corrective amendment has been made.

#### ***Specification***

The Examiner objects to the specification because an obvious error exists at page 27. Applicant thanks the Examiner for catching this error and has amended the specification accordingly.

#### ***Claim Objections***

The Examiner objects to the claims because of certain informalities. Again, Applicant thanks the Examiner for identifying these errors and has amended the claims accordingly.

#### ***Claim Rejections - 35 U.S.C. § 112***

**Claim 42 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.** The Examiner notes that the claim recites "a patter of which a design size if 4um or more and 2.0um or less." The Examiner questions the first value should be 0.40. Applicant thanks the Examiner for catching this error and has amended the claim accordingly.

#### ***Claim Rejections - 35 U.S.C. § 102***

**Claims 21-28, 30-32, 36-40, 42 and 43 are rejected under 35 U.S.C. § 102(b) as being anticipated by Kwon et al (Loading Effect Parameters at Dry Etcher System and Their Analysis at Mask-to-Mask Loading and within Mask-Loading:" SPIE Vol. 4562 pp 79-87).** This rejection is traversed for at least the following reasons.

First, Applicant wishes to note that they have amended independent claims 21, 31, 39 and 43 in order to specify that the dry etching gas comprises Cl<sub>2</sub> and O<sub>2</sub>.

Second, Applicant notes that the Examiner asserts that Kwon teaches etching a Cr photomask using an ICP, Cl<sub>2</sub>, O<sub>2</sub> together with the use of an organic resist, a photoresist coverage, photoresist etch selectivity of less than 1.5, and parameters that match those use by

Applicant. The Examiner concludes that Kwon is considered to etch at a power level below that which causes a jump in plasma density and that, therefore, claims 21-28, 30-32, 36-40, 42 and 43 should be rejected.

The Examiner's rejection is clearly based on a mere assumption and is not based on any direct teaching, suggestion or other evidence. In addition, Applicant submits that Kwon does not have any description with respect to the use of inductively coupled plasma (ICP) in etching. Thus, there is no suggestion that a plasma density jump might take place in Kwon.

Kwon does enumerate various etching conditions that might be individually selected or combined and does investigate an influence of such etching conditions on loading. However, there is no disclosure at all about any plasma density jump and any influence on power reduction. In the absence of any recognition of the influence of a plasma density jump on power reduction, it would not even be obvious to try to use conditions that might achieve that result.

Specifically, Kwon discloses, in Fig. 4 (a), a relationship between PR side erosion and source power. In Fig. 4(a), a single peak appears in ISO-dark, dense-dark, and dense-dark patterns. Applicant submits, however that one skilled in the art would not know from this disclosure that there may be a best condition between (1) the source power and (2) the side erosion. The reason is that the side erosion tends to decrease when the source power is increased or decreased from about 180(W). In other words, Kwon never teaches optimum plasma excitation power suitable for dry etching. Thus, Kwon never discloses a relationship between plasma excitation power and verticalness of a sectional shape of a pattern claimed in amended claim 21.

Accordingly, Applicant respectfully submits that amended claim 21 is not obvious from Kwon.

Similarly, Applicant respectfully submits that amended claim 39 is not obvious from Kwon.

Finally Applicant submits that the claims dependent from each of claim 21 and 39 are patentable.

Third, Applicant notes in connection with claims 28, 29, 30, 31, 32 to 38, and 43 that etching is carried out in the presence of an organic substance, except a resist layer. Inasmuch as Kwon is completely silent about such an organic substance, Applicant respectfully submits that claims 28, 29, 30, 31, 32 to 38, and 43 are novel and are not obvious from Kwon.

Finally, in claim 23 and dependent claims 24, 25 and 27-30, high-frequency power is applied to supply chemical species in a direction perpendicular to a thin film and to control ion energy due to bias power independently of ion flux due to discharge power. This serves to precisely control a pattern configuration. By contrast, there is no teaching, suggestion or other disclosure in Kwon with respect to the supplying the high-frequency power.

***Claim Rejections - 35 U.S.C. § 103***

**Claims 29 and 33-35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kwon and further in view of Hoshino (4,613,401).** This rejection is traversed for at least the following reasons.

In framing the rejection, the Examiner asserts that Hoshino teaches adding ethanol vapor to a plasma etching gas specified by a gas of  $\text{CCl}_4$  and  $\text{O}_2$ . On the other hand, the dry etching gas according to the present invention comprises  $\text{Cl}_2$  and  $\text{O}_2$ . Applicant notes that amended claim 21 is restricted to a dry etching gas of  $\text{Cl}_2$  and  $\text{O}_2$ .

Applicant notes that in Hoshino, a dry etching product,  $\text{CrO}_2\text{Cl}_2$ , is reduced into chemically stable  $\text{CrCl}_3$  when etching is carried out by the use of the gas  $\text{CCl}_4$  and  $\text{O}_2$ .

On the other hand, the present invention carries out etching Cr thin film by the use of a gas comprising  $\text{Cl}_2$  and  $\text{O}_2$ . With this reaction, there is no problem wherein Cr atoms, released by the decomposition, deposit on the Cr film to be etched, as pointed out in column 1, lines 21 to 39.

In other words, Hoshino has no teaching or suggestion for adding the organic gas, such as ethanol, to promote deposition of an organic substance onto a side wall of a resist.

Accordingly, Applicant respectfully submits that claim 29 is also patentable over Hoshino and Kwon. This applies to claims 33 to 35 as well.

**Claim 41 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Kwon and further in view of Zhang (6,989,603).** This rejection is traversed for at least the following reasons.

The Examiner cites Zhang because the Examiner admits that Kwon does not teach a mask comprising an optical proximity correction pattern. The Examiner asserts that it would have been obvious to one skilled in the art to fabricate a mask having such pattern on the basis of the teachings of Kwon because Zhang teaches that such masks are well known. However, Zhang does not remedy the deficiencies of Kwon, as noted above. Specifically, claim 41 is also patentable because it is dependent on claim 40, which itself would be patentable for the reasons given above. Thus, the rejection should be withdrawn.

#### *New Claims*

New claims 44 and 45 are added to define a relationship between the plasma excitation power and the high-frequency power. New claims 44 and 45 are based on the description on page 13, lines 5 to 10 of the specification and are effective to appropriately deposit the organic substance on the resist side wall during etching Cr. Applicant respectfully submits that the new claims 44 and 45 are also patentable over Kwon because no teaching is made at all in Kwon about the relationship between the plasma excitation power and the high-frequency power.

Finally, Applicant wishes to note that the present invention would be advantageous in that no temperature controlling mechanism is needed, as described on page 18, the bottom line to page 19, lines 1 and 2; page 21, lines 17 to 19; and the like. This would result from the fact that the plasma excitation power is lower than power at which plasma density jumps occurs.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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